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MEMORANDUM

SUBJECT: WQCP protection gaps

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TO: Karen Schwinn, (WTR 1)

Protection of Beneficial Uses in the Bay Delta with Particular Regard to Fishery Resources

Most of the traditionally valued fishery resources of the central valley, particularly those that rely on conditions in the delta, have experienced sharp declines in abundance in recent years. Salmon fisheries have been closed on the west coast of North America largely as a result of poor abundance in Central Valley stocks. Abundance estimates of pelagic species in the delta continue to generally set new lows each year (2009 results represent new lows for 3 of the 4 POD species) and there is widespread expectation that extinction is a likely near-term result.

The State Board in 2006 largely re-adopted their 1995 Plan, but a new staff report and discussion by staff and board members at several public meetings suggest that they recognize that conditions in the delta that are not protective of pelagic and migratory fish.

New biological opinions for listed species have pointed at some of the likely inadequacies of the previous water quality control plan in regard to protecting delta smelt, chinook salmon, steelhead, green sturgeon (and by implication the southern population of orcas). New planning efforts, particularly the Bay Delta Conservation Plan (BDCP) attempt to address the plethora of other stressors affecting aquatic resources in the delta. Some water quality stressors, particularly ammonia, are being addressed by the Central Valley Regional Board, to whom the State Board is ceding precedence.

Studies by the Interagency Ecological Program in recent years have led to more in-depth understanding of some aspects of the delta environment and filled data gaps that have been decried for years. Many of these results have been published in the scientific literature and their strengths, weaknesses and implications have been discussed at length.

I have not reviewed all of the voluminous text of the two biological opinions but the depth of science upon which they are based, I suspect is greater than for most any other biological opinions. Salmon and steelhead have an enormous worldwide literature as well as decades of local studies upon which the NMFS BO has drawn. At the other extreme, delta smelt occupy such a restricted area and has been subjected to such intense recent analysis that FWS had abundant recent and relevant knowledge to bring to bear for the Delta Smelt Biological Opinion. In addition the FWS brought together a team of the scientists that have been doing this work to help develop the Biological Opinion and ensure that it was

correctly applying the knowledge gained. Two independent science reviews strongly supported the FWS opinion. National Academy of Science reviews of both opinions are expected in 2010.

Both biological opinions were re-issued at court order because the previous versions were found inadequate. The reasonable and prudent alternative of the current delta smelt opinion is largely consistent with the court-ordered requirements that ruled while the new opinion was written in 2008. The only real addition was protection of habitat in the fall where the FWS was presented with clear evidence that that seasonal habitat had been severely degraded since 2000. The publications documenting this habitat degradation were not available when the judge issued his set of requirements for 2008. The NMFS opinion, on the other hand, includes many features not previously seen. Both opinions are the subjects of a large number of lawsuits that are unlikely to be addressed before 2011.

The SWRCB staff report is an excellent summary of the issues facing the board.

There are stressors and planning issues that I fear are not being adequately addressed in any of these efforts. This memo summarizes my concerns.

In several ways the biological opinions and WQCP fail to protect present and predictable habitat needs of estuarine species. The delta is an estuary, and as such its essential characteristics for resident and anadromous fish are: salt gradients from the rivers to the bay, high residence times where tidal flux impedes the net movement of water and particles, and intermingling shallow and deep habitats where tidal marshes connect to open water habitats.

There are foreseeable changes to the estuary that are likely to require planning if beneficial uses are to be protected. Anticipating changes in the delta due to climate change are the exact sort of 'adaptation' that EPA has been vigorously promoting elsewhere. The largest of these changes is the transformation of the western delta 'islands' into a series of semi-isolated open water habitats as a consequence of levee failure, uncontrolled floods and/or seismic activity, as described in the Public Policy Institute of California (PPIC) reports. The (BDCP) attempts to guard against some of these impacts by siting restoration efforts in areas that are near sea level and so should retain some of their value in future scenarios. However, these changes in geometry will produce unavoidable changes in salinity, flows, and other aspects of aquatic habitat.

Our estuary has been invaded by new species throughout the last 160 years and will continue into the future. Most imminently, freshwater mussels have been found in watersheds of the Central Valley and so can be expected to invade the Delta very soon. Similar invasions by clams in previous years have led to fundamental changes in the estuary and some of the impacts of expected invaders can be anticipated. Of course, there are potential invaders from around the globe whose impacts cannot be foreseen, but where we have reasonable predictions of invasion, management should anticipate their impacts.

There are the many expected changes to the estuary that are generally under the control of management or where there is current conflict between contradictory management goals. Current trends, present management choices and other likely short term changes will affect the adequacy of the

WQCP. Understanding these interactions and conflicts would greatly facilitate successful management. The largest issues include increases in nutrient and contaminant loadings from the growing cities of the Central Valley, the increasing use of pyrethroid pesticides in both agricultural and urban environments. Direct management issues include the BDCP proposals to reconfigure the delta and increase both upstream and downstream storage. Restoration of the San Joaquin River does not seem to be addressed in any other planning efforts, although its demands and impacts on the delta are large.

Finally, there are issues of rising scientific issues that are likely to allow greater management possibilities in the near future. Such areas are ripe grounds for real adaptive management plans. These include the re-authorization of the Vernalis Adaptive Management Plan, the north delta Salmon migration studies and various efforts to improve success of fish salvage procedures at the State and federal water intakes.

Missing pieces for current conditions are:

1. Adult steelhead upmigration in the San Joaquin Valley. Pulse flows are required both by the WQCP and the NOAA BO in the Stanislaus to attract adult steelhead but they are grossly less than the level of exports allowed at the same time in the south delta. This might well be addressed by a brief window when the pulse flow on the Stanislaus is accompanied by a minimization of SWP and CVP diversions for a few days. Adults are capable swimmers and connection of river flow between Vernalis and the central delta for even a few days is likely to be enough to allow them to orient to their home streams and exit the delta. The level of flow and export should be adequate to produce riverine habitat with a linear salinity gradient from the bay to Vernalis. Present modeling tools are more than adequate to predict the required flows under a wide array of possible tidal and meteorological conditions. Measurements of salinity could easily serve as proximate performance measures in producing the required habitat. The number of returning adult salmon and steelhead to the Stanisalus, Merced and Tulomne rivers would be an ultimate performance measure.

2. Low salinity habitat in the autumn. The 1994/2006 WQCP established criteria for the protection of both the extent and diversity for the low salinity habitat in the months from February through June. Protection of that habitat was considered important because diverse scientific studies had shown its ecological importance and management actions had greatly restricted its abundance across decades. Beginning in 2000, the extent of low salinity habitats in the autumn was drastically reduced and ceased varying from year to year. Meanwhile studies had shown that this was the critical habitat for delta smelt and was closely tied to its successful reproduction. The USFWS BO includes restoration of this habitat in wet and above normal years, when it had formerly been more abundant but the requirements are less than occurred as recently as the late 1990s. The BO calls for a Habitat Study Group to analyze the benefits of habitat restoration in the fall. However, the intent seems to be to find alternative ways to achieve habitat benefits rather than quantifying the amount of habitat required for recovery. Information upon which the action was based imply that both greater amounts of habitat and

higher inter and intra annual variability in such habitat volumes are reasonable requirements when more information is available.

3. San Joaquin salmonids outmigration. San Joaquin salmonids are the subject of the Vernalis Adaptive Management Program which has been in place since 2000. All measures of survival have been low except during flood years. Attempts to generate managable high flows under which to measure survival have failed. This is a crucial information gap. Originally, VAMP was to determine the relationships between export rates and river flows. However, both biological opinions greatly restrict exports during the VAMP period, and extend Export restrictions from 31 days to 60 days providing almost no opportunity to examine the effects of export rates. VAMP studies in recent years have suggested that mortality of salmon is high in particular hot spots and that river flow may change the impacts of such mortality 'hot spots' as well as in aiding smolt migration success. For VAMP to succeed, especially under the current extreme concern about salmon populations, periods of higher flows must be provided in a way that does not conflict with the need for carryover storage to permit successful spawning. The NMFS Biological Opinion directs BOR to purchase water to achieve higher flows in later years since the BOR is the subject of the BO. However, the limited information available strongly suggests that current flow requirements are inadequate to protect outmigrating salmon and a more protective baseline should be established by the SWRCB. VAMP studies could then be used to refine flow targets and/or to help reduce local sources of mortality after fish populations have rebounded.

4. Conflicts among fish needs. Some parties have made much of the potential for interference between the NMFS opinion requirements for greater storage to provide cold water releases for salmon and steelhead and the Smelt opinion requirements for greater outflow in the fall of some years. Modeling done in support of both opinions show that there is very limited actual conflict, largely because the greater outflows called for by the smelt opinion come only after wetter springs when storage is higher. BDCP is focusing on delta inflows (and bypass flows) in describing ecosystem flow needs and in fact some BDCP discussions have suggested lowering outflow requirements. This highlights the different physical effects of inflows vs outflows on riverine conditions and delta hydrodynamics. In brief, outflow goals are usually met by restricting exports rather than by re-operating reservoirs. In general, outflow requirements have limited effects on either reservoir storage or riverine conditions. However, salmon migration (either as downmigrating smolts or upmigrating adults) is affected by riverine conditions. Thus, the greatest conflict is between river flow requirements as delta inflow to improve salmon passage success and upstream storage carryover requirements t improve salmonid spawning success. As with the VAMP, setting protective flow levels on the Sacramento side that do not interfere with adequate carryover storage targets is a suitable subject for intensive experimental studies. Delta inflow requirements should be coordinated with outflow requirements but since they provide very different habitats for very different species they should not be comingled.

5. Performance measures. Since using striped bass young-of-year abundance in the 1978 plan, the SWRCB has not used performance measures to either target or measure success of their standards. The decades long experience with the Summer Townet Index and the Fall Midwater Trawl Index (modified for use as delta native fishes recovery indices in the FWS Recovery Plan) provides obvious performance measures to assess adequacy of WQCP standards. Quantification of volumes and areas of present and historical habitat suitable for delta smelt, striped bass and threadfin shad permits standards to be set that directly address the flow based nature of essential habitat for these species. Other factors may prevent fish from fully utilizing the available habitat but protecting the habitat of endangered species should be a basic level of protection.

   Population estimates for salmon are robust and can be augmented with recent tools allowing estimates of migration success. In 1995 the SWRCB adopted language very similar to the Central Valley Project Improvement Act in aiming for a doubling of salmonid production relative to a late 1960s a reference period. Although adopted as a narrative standard, the SWRCB has not used this standard to assess the success of its WQCP. New technologies allow much more confident measurements of salmon passage through the delta and identification of areas and conditions of high mortality.

Many future protective needs of the delta can be anticipated from current trends and actions. Neither the simple nor the interactive effects of these likely trends seems to be addressed:

1. Ammonia and other urban contaminant loads will increase. Ammonia/um loading is a straightforward function of human population size and wastewater treatment technology. Ammonia loads from Sacramento show a linear increase and the county population grew by 13% in the last 10 years. BDCP development assumes higher levels of exports from the delta. Thus, loadings can reasonably be expected to increase while the volume of the receiving waters decreases. A new point of diversion could also exacerbate the effects of wastewater discharge by resulting in higher concentrations. The ecological impacts of these changes should be analyzed together and control of the impacts addressed in advance. Wastewater permit requirements should reflect the impacts of expected population growth and changes in the receiving water bodies.

2. Major efforts are underway to increase both the quantity and quality of water removed from the delta with likely greater impacts on water quality and fish in the remaining water. The SWRCB staff report points up a number of concerns about the effects of current export levels on fish, water quality and salt accumulation in the San Joaquin Valley. By failing to include lower export scenarios the BDCP cannot meet the range of future conditions that the SWRCB has identified as necessary in order to address, and impacts of drainage in regard to soil salinity, groundwater contamination, selenium discharge from the valley. Coordination with the San Joaquin River restoration effort has been missing from any discussion I have seen.

3. The San Francisco Estuary has long been described as the most invaded estuary in the world. This trend of biological invasions has accelerated through time and shows no indication of slowing down. Invasive species are usually successful in areas where large changes in the physical habitat have occurred. Climatically or seismically-induced changes in the delta or intentional large-scale changes in flows, geometry and habitats as proposed in the BDCP are likely to accelerate the invasion and spread of invasive species. DWR has a plan to deal with the water management impacts of the invasion of quagga and/or zebra mussels and have extrapolated where the mussels are likely to be a problem based on water chemistry. However, all other planning documents address invasive species only in terms of tools to slow down or reduce the spread of new invaders. Management of freshwater mussels could be informed by the experience of many areas in the rest of the world.

4. Climate change has already profoundly changed California's aquatic environment with more frequent floods, less snow and more rainfall and can only be expected to increase the severity and frequency of its impacts. The NMFS Biological Opinion for salmonids includes a number of long-range efforts directed toward protecting these resources under likely future conditions. Combing greater floods, rising sea level and seismic uncertainties, the PPIC reports described several alternative futures for the delta. Although initially embraced by many and widely discussed, the material of the PPIC reports has not been incorporated into much of the planning or management discussions. The preferred dual-conveyance in the BDCP is particularly at odds with the predicted loss of the delta as a stable geometry. I am unaware of any planning efforts that address what beneficial uses will pertain to a delta with many breached levees. Some beneficial uses will inherently be lost; for others the standards required to protect beneficial uses will be substantially changed. Since unintended reconfiguration could occur rapidly and at any time, some vision of how to manage this future delta would be very useful. Such a vision would also identify a number of monitoring and management options that could be started now to improve our response to future changes.